

THE VOICE AND RELATIONSHIP OF THE TREEFROG
HYLA HOBBSI (ANURA: HYLIDAE)

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Abstract.—The vocal signal of *Hyla hobbsi* consists of two types of calls: one call type is a single prolonged note with little frequency variation; the other is a frequency modulated three-note call. The two call types probably have different functions. There are basic differences in call, color, and habitat between *Hyla hobbsi* and *H. punctata*, a species with which *hobbsi* has been confused.

Introduction

Cochran and Goin (1970) described the treefrog *Hyla hobbsi* from six specimens collected along Caño Guacayá, Amazonas, and the Río Apaporis, Vaupés, Colombia. They called attention to the black dorsal spots, glandular dorsolateral folds and other structural features of the preserved frogs and concluded that *Hyla hobbsi* was not closely related to other known members of the genus *Hyla*. Duellman (1974) examined the holotype of *H. hobbsi* (MCZ 28052) and decided on the basis of morphological similarities that it was an example of *Hyla punctata*, a widespread and well-known neotropical species. Nonmorphological data were not given by these authors and apparently neither Cochran and Goin nor Duellman had seen live specimens of *Hyla hobbsi*. My objectives herein are to characterize the voice, habitat and habitus of *Hyla hobbsi* and to clarify its relationship with *Hyla punctata*. The voice recordings were made at night with a Uher 4000 Report L tape recorder at a tape speed of 19 cm/s and analyzed in the laboratory with a Key Elemetrics Sonagraph, model 6061 B.

Voice

In June 1973 J. K. Salser and I recorded calls (air temperature, 24.5 C) and collected 12 specimens of *Hyla hobbsi* on Wacará Creek, Vaupés, Colombia. The frogs called from widely separated shrubs along the stream and each shrub usually held only one frog. Perched over water, the frogs were reluctant to jump even when the shrubs were bumped by our canoes. Other specimens of *H. hobbsi* were brought to us from time to time by Caqua Indians, whose village is near Wacará Creek.

The calls of *Hyla hobbsi* are given in long sequences interrupted by pauses of several seconds. A sequence usually consists of two types of calls (Fig. 1): a plaintive whistle (type A) and a three-note call of variable

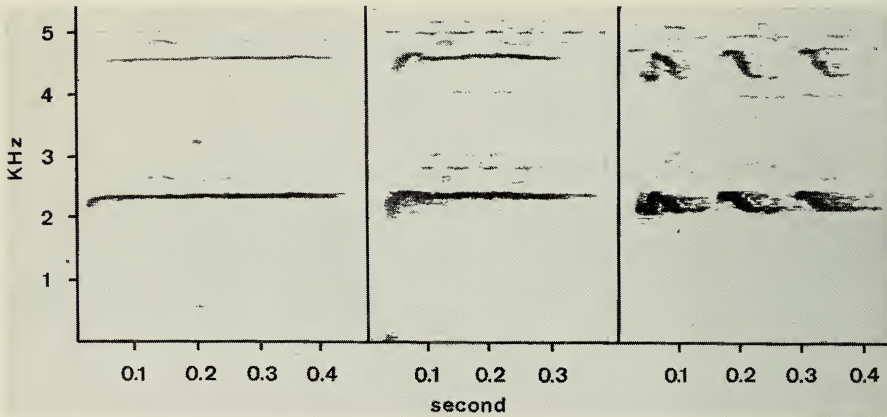


Fig. 1. Sound spectrograms of calls of *Hyla hobbsi*. Left, type A call; center, transitional type A call; right, type B call.

pitch (type B). Calling is not random. Chorusing begins when one frog utters a type A call and is answered with a type A call by a nearby frog. The two call alternately several times, then others join in. Early in the chorus there seems to be little overlap of calls given by individuals close to each other. After a few minutes the singers fall silent, then begin again as before. I have heard similar, apparently coordinated, chorusing by *Osteocephalus taurinus* in a flooded gallery forest on the Colombian llanos.

The following description is based on a sequence of 47 calls given by one male *Hyla hobbsi*. In this sequence the first 15 calls were type A and 29 of the remaining 32 were type B. The voice of this individual seemed typical of other members of the chorus, some of which can be heard on the same tape.

The single notes of 15 type A calls have a mean duration of 0.49 s (range, 0.35–0.65) and a repetition rate of 25.7 calls per min. There is a dominant frequency band, apparently the 10th harmonic, at 2,490 Hz (2,080–2,625 Hz) and a weak secondary band, possibly the 19th harmonic, at 4,830 Hz (4,580–5,000 Hz), as measured at the midpoint of the bands. The first two type A calls are almost pure tones with a maximum dominant frequency band width of 250 Hz, after which there is an increase in maximum band width due to a rise in frequency at the beginning of each note (Fig. 2).

Type B calls of *H. hobbsi* are trills consisting of 3.1 (3–5) notes per call. The call duration is 0.46 (0.39–0.65) s and each note lasts about 0.12 s with poorly defined silent intervals between notes within a call. Mean frequencies of the dominant and secondary bands are the same as in type

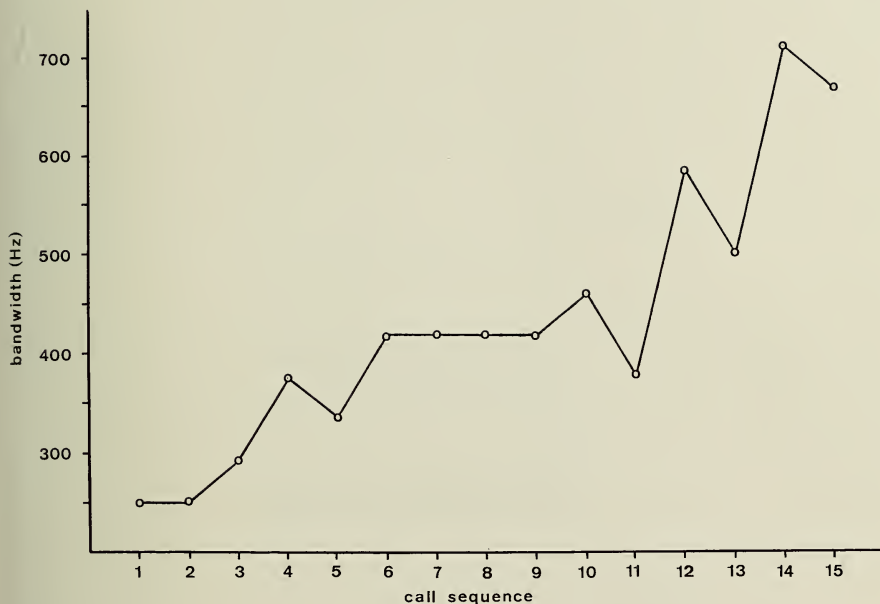


Fig. 2. Increase in maximum dominant frequency bandwidth with call sequence.

A calls. Maximum width of the dominant frequency band is constant within a call but varies irregularly between calls from 420–875 (\bar{x} , 645) Hz. The frequency of the first note in each call rises and falls, after which each note decreases in frequency from beginning to end of note. Repetition rate of type B calls is 103.4 per min and the note repetition rate, excluding intervals between calls, is 7.1 notes per s.

Recordings of vocalizations by *Hyla punctata* 12 km NNE of Villavicencio, Colombia (Fig. 3; see also Hoogmoed, 1973) show that the voice of this species is quite unlike that of *Hyla hobbsi*. The frogs were calling near the ground in grass at the edge of a swamp (air temperature, 22.6 C). Thirty trilled calls of six individuals consist of 3–10 (\bar{x} , 5.4) short, evenly spaced notes in which the energy is broadly distributed through the frequency spectrum. There is a poorly defined emphasized band at about 1,400 Hz and lesser bands ranging up to 5,000 Hz. The call repetition rate is 16.6 (7.0–25.7) per min, the duration 0.30 (0.18–0.48) s and the note repetition rate is 19.1 (16.7–22.2) per s. An individual recorded near Puerto Lleras, Colombia, called much more rapidly (80.9 calls per min; air temperature, 24.4 C), but otherwise its calls were like those recorded near Villavicencio. The fast-calling Puerto Lleras specimen was accompanied by *Hyla wandae*

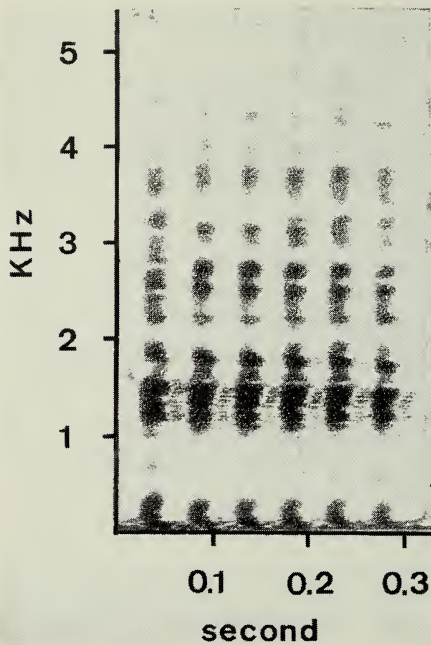


Fig. 3. Sound spectrogram of call of *Hyla punctata*.

and *Hyla mathiassoni* but not by other *H. punctata*, whereas the Villavicencio specimens were part of a chorus of *punctata*.

I cannot make precise quantitative comparisons of the voices of *Hyla hobbsi* and *Hyla punctata* because I have recordings of only one *hobbsi* that are suitable for analysis; however gross differences in the voices of the two species are apparent (Figs. 1 and 3). *H. punctata* produces one type of call, a poorly tuned series of short, rapidly repeated notes. Vocalizations of *H. hobbsi* consist of two types of calls: type A is a single prolonged note in which most of the energy is confined to a narrow dominant frequency band; type B consists of three short, frequency modulated notes.

Morphology

The type series of *Hyla hobbsi* consists of two adult females, two adult males and two juveniles. One juvenile and all of the adults were collected 14 May 1952, at which time at least one of the females (MCZ 28052) had mature ovarian eggs. The males have large vocal slits, sharp prepollical spines and are about 38 mm in snout-vent length. The females are about 42 mm snout-to-vent and have no prepollical spines or vocal slits. All of the specimens are distorted as a result of bad positioning at the time of

preservation. The dorsum varies from light gray to brown, with small, discrete, black spots. Dorsolateral glandular folds are variably in evidence, having been adversely affected by preservation in some specimens. Other than differences associated with sex or age, the preserved series of *H. hobbsi* from Wacar agrees in detail with the type series of *hobbsi* and with the description by Cochran and Goin (1970). Measurements in mm of 26 adult males from Wacar are (\bar{x} followed by range): snout-vent, 38.7 (37.4-40.1); head length, 14.3 (13.0-15.3); head width, 13.7 (12.7-14.4); eye length, 4.8 (4.3-5.1); ear diameter, 2.1 (1.6-2.5); shank length, 20.1 (19.2-21.0); width third finger disc, 1.8 (1.4-2.1).

In life (Fig. 4) the dorsum of 17 specimens of *Hyla hobbsi* from Wacar varied from pale green through shades of gray and tan to medium and dark brown. Small black spots were irregularly spaced over the dorsum, as in the preserved animals. A pale cream stripe extended from the tip of the rostrum along the canthus rostralis and edge of upper eye lid, over the tympanum, and dorsolaterally on the body to the groin. Lateral aspects of the head and body (below the cream line) were the same color as the dorsum, becoming paler where the color of the side merged with the lighter ventral surface. The skin of the venter was greenish white, translucent, and the iris was yellow. Anterior and posterior surfaces of the thigh and lower side of the shank were brownish to mustard yellow.

Preserved specimens of *Hyla punctata* and *H. hobbsi* are structurally similar but may be distinguished by the absence of black spots and general loss of color in *punctata*. *H. hobbsi* does not fade to white in preservative and retains the black dorsal spots that are conspicuous in the live animal.

Live *Hyla punctata* undergo a remarkable day-night color change that does not occur in *H. hobbsi*. At night *punctata* are yellow, orange or red with bright red spots and dorsolateral lines. (See color photographs in Hoogmoed, 1972 and Crump, 1977); during the day they are green. Specimens of *hobbsi* kept alive by me for several days to more than a year changed color among shades of gray, green and brown but were never yellow, orange or red and metachrosis was not correlated with the day-night cycle.

Habitat

Hyla hobbsi is known only from the Amazonian forest of southeastern Colombia. All of the live specimens I examined (UTA-3793-94, 3796-97, 3799, 3800-08, 3810, 3899, 3900-10; USNM 198548-49) were taken along Wacar Creek, a clear, brown, sand-bottomed stream that flowed through virgin rain forest to the Vaups River. The stream was about 5 m wide and 1 m deep at a point near the village of Wacar on 5 June 1973, but the depth varies greatly with rainfall.

Hyla punctata probably does not breed in the clear streams of undis-



Fig. 4. Live specimen of *Hyla hobbsi*; from color transparency by Harry Greene.

turbed rain forest. In Colombia, *H. punctata* frequents open savanna and the savanna, scrub-forest ecotone where males call from grasses and herbs at the margins of lakes and swamps. Hoogmoed (1973) reported it in similar habitat in Surinam where the frogs called from the leaves of *Montichardia* sp. in a swamp and Lescure (1976) found *H. punctata* to be common in prairie marshes in French Guyana. In Trinidad, Kenny (1969) found *punctata* "usually in grasses or bushes, and almost always over slowly moving water . . . in choked ditches or rivers," generally in open country. Near Leticia, Colombia, Goin and Layne (1958) found *punctata* "most abundant in wet open pasture lands" and collected one specimen on a bush in the water of a stream cove.

Discussion

Preserved specimens of treefrogs are often deceptively similar and great care should be taken in forming conclusions about species relationships based solely on structural features. In the present instance differences in life colors, habitat and breeding call show that *Hyla punctata* (Schneider) and *Hyla hobbsi* (Cochran and Goin) are different species, not conspecifics as Duellman (1974) concluded. Furthermore the mating calls of *punctata* and *hobbsi* are so distinctly different that close relationship between the two species is doubtful.

Aside from its systematic implications, the unique call of *H. hobbsi* is of interest in attempting to explain the functions of anuran vocalization. The non-random calling sequence and separation of individuals in different shrubs along the stream at Wacar indicate that male *hobbsi* maintain a territorial hierarchy by vocal signaling. Hierarchical calling was discovered by Goin (1949) in *Hyla crucifer* and has since been found in several other anurans (Duellman, 1967). When two types of calls are given, as in *H. hobbsi* and some other species (Straughan and Heyer, 1976; Narins and Capranica, 1976), the signals may have different meanings for the two sexes. Thus the latter authors found that territorial males of *Eleutherodactylus coqui* produce a two-note call in which the first note functions in interactions between males and the higher-pitched second note serves to attract females. Whether one call type of *H. hobbsi* is sexual and the other territorial is not known, but in view of the complexity of the signal and behavior of males at the breeding site it seems likely that both territorial and species identity information are conveyed by the calls.

It has been established that in several species of anurans gravid females are attracted to the mating calls of males (Martin, 1972; Blair and Littlejohn, 1960; Littlejohn et al., 1960). Furthermore the anuran ear is tuned to particular frequency bandwidths (Loftus Hills and Johnstone, 1970) apparently in most cases to the dominant frequency of the mating call (Straughan, 1973). A basic design feature of anuran calls that would in-

crease efficiency by minimizing interference from other sound sources is a restricted frequency bandwidth (Straughan, 1973), as in the type A call of *Hyla hobbsi*. The type A call is a prolonged, relatively unmodulated tone with virtually all of the energy limited to a very narrow dominant frequency band. The precise source of this type of sound is very difficult to locate (Nelson, 1973), but because of the lack of interference from other sounds type A calls should carry well and possibly be heard by females at great distances from the chorus, as well as by distant males along the stream. Thus the type A call may serve as an orienting signal to distant receivers, indicating the general location and species identity of the transmitter. The type B call of *H. hobbsi*, consisting of short notes with wider bandwidth than A calls, would be less effective at long distances because of interference, but should make the transmitter easy to locate by females that have gotten within close range. Type B calls may also be important in maintenance of the hierarchical calling sequence among nearby males.

By reducing the dominant frequency bandwidth selection may have increased the range of the species identity component at the expense of a location component that would require a wider bandwidth (see Straughan, 1973:324). Perhaps retention of both types of information was accomplished by separating the signal into two call types. The transitional nature of some calls of *H. hobbsi* shows that in this species the differentiation of calls is not complete.

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